MAINTENANCE DREDGING

MIANUS RIVER
MIANUS, CONNECTICUT

DRAFT ENVIRONMENTAL STATEMENT

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

JANUARY 1977

DRAFT

ENVIRONMENTAL IMPACT STATEMENT

ON

MAINTENANCE DREDGING AT

MIANUS RIVER

GREENWICH, CONNECTICUT

January 1977

New England Division
U. S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

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1. Project Description

The headwaters of the Mianus River lie in the southeastern corner of New York State, from whence the river flows about 20 miles in a southerly direction and empties into Captain Harbor through Cos Cob Harbor. Vessel traffic on the river is from its mouth to a dam at the Village of Mianus (immediately north of U.S. Route 1), a distance of 1.8 miles.

The original project was adopted in 1892, modified in 1896, and then abandoned in 1905. Work accomplished through 1899 consisted of dredging a channel 6 feet deep to a point about 1,600 feet upstream of the railroad bridge at Cos Cob and partial completion of a turning basin at the head of Cos Cob Harbor.

The existing project authorized by the River and Harbor Act of March 2, 1945, provides for a channel six feet deep and 100 feet wide from Cos Cob Harbor to Route 1, Mianus, a distance of 1.2 miles (see Figure 1). The improvement work was completed in 1951, necessitating removal of 200,000 cubic yards of material and disposal at a site south of Stamford in Long Island Sound.

Since completion, maintenance dredging has been accomplished once, in 1964, when approximately 18,000 cubic yards of material was removed from the channel and disposed of in Long Island Sound at the same site south of Stamford.

A condition survey of the project was undertaken in March 1975. At that time, the outer portion of the channel from the Penn Central Railroad Bridge to the downstream limit of the Federal project was essentially at its authorized depth of six feet at Mean Low Water and 100 foot width. The area between

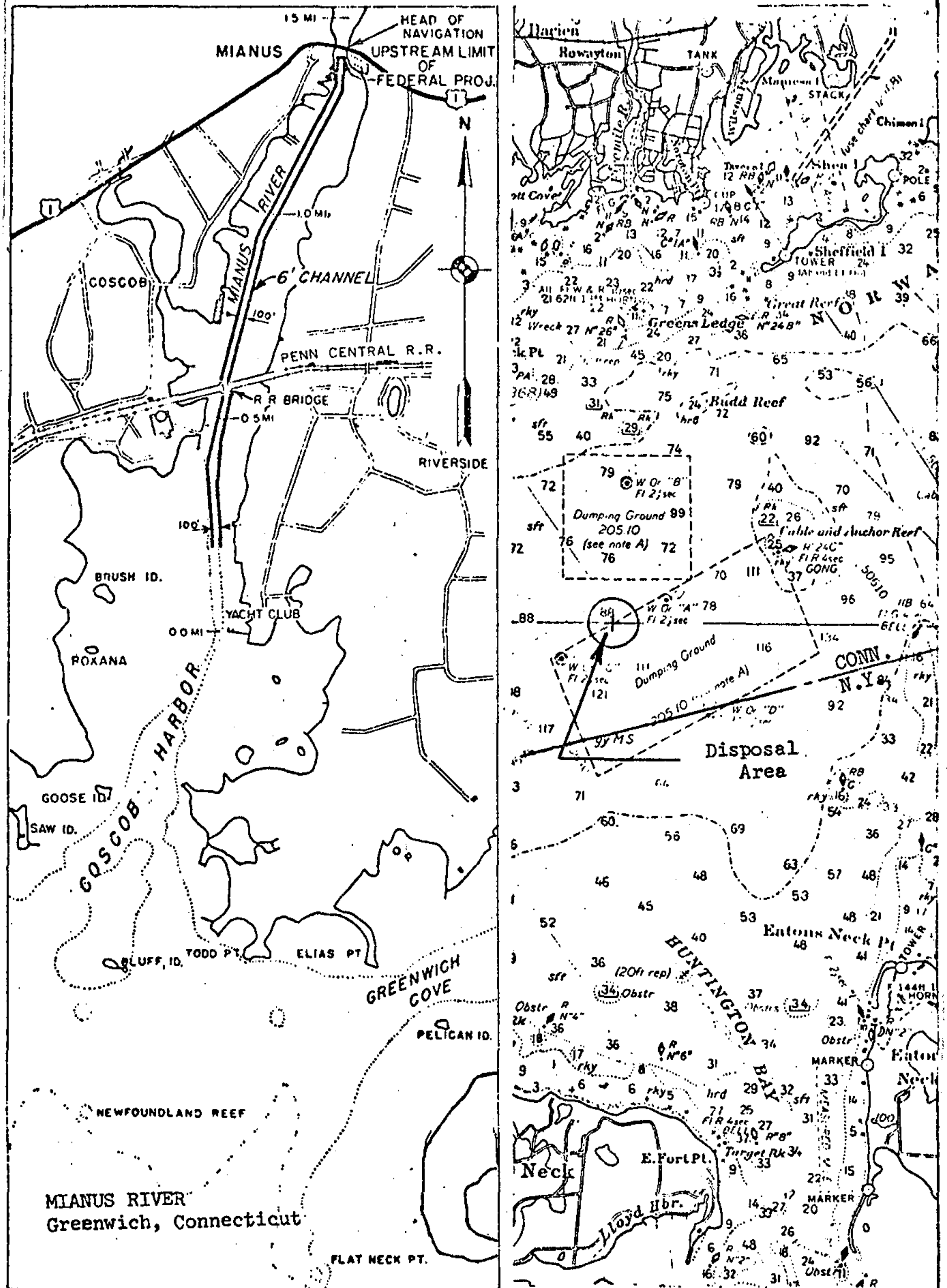

MIANUS
HEAD OF NAVIGATION
UPSTREAM LIMIT OF FEDERAL PROJ.
1.5 MI
N
MIANUS RIVER
1.0 MI
6' CHANNEL
100'
COSCOB
PENN CENTRAL R.R.
R.R BRIDGE
0.5 MI
RIVERSIDE
BRUSH ID.
YACHT CLUB
0.0 MI
ROXANA
COSCOB HARBOR
GOOSE ID.
SAW ID.
BLUFF ID.
TODD PT.
ELIAS PT.
GREENWICH COVE
PELICAN ID.
NEWFOUNDLAND REEF
FLAT NECK PT.
MIANUS RIVER
Greenwich, Connecticut
Darien
Rowayton
TANK
STACK
Chimon I
Sheffield I
TOWER
POLE
Great Reef
Greens Ledge
NORWA
Budd Reef
Dumping Ground
205.10
(see note A)
Cable and Anchor Reef
GONG
BELL
Dumping Ground
CONN.
N.Y.
Disposal Area
Eatons Neck Pt
HUNTINGTON BAY
MARKER
E. Fort Pt.
Lloyd Hbr.
Neck

FIGURE 1

the Railroad Bridge and the Connecticut Turnpike, Interstate 95, was found to have shoaling only on the east side of the channel. This shoaling reduced the available depth of six feet at Mean Low Water from the authorized 100 foot width to approximately 60 feet in several places. North of I95 to the upstream limit of the project, more extensive shoaling was evident on both sides of the channel. The section of the project on the west side of the channel, from the Penn Central Railroad Bridge to the upstream limit of the project, is the area in which mariners are concentrated along the Mianus River. This area is the area in which the most shoaling has occurred, with the greatest shoaling taking place in the area north of I95.

a. The Proposed Maintenance Dredging Project. Maintenance dredging is proposed for the Mianus River project to restore it to its authorized dimensions. Based on hydrographic survey data, this will involve the removal of about 25,000 cubic yards of material to attain the six foot channel depth. A clamshell or bucket dredge will be used to dig the material and place it in dump scows. These dump scows will be towed to an open water site for disposal of the material. Since the project site is heavily used by recreation boaters, there will be no dredging during the peak boating season. Dredging operations will commence in the spring of 1978 and is expected to be completed before the boating season in May 1978.

The material will be hauled to sea and disposed of in the Eatons Neck disposal area. The proposed disposal area is 500 yards in diameter, the center of which is located at 41°-00'-00" N and 73°-27'-00" W. A buoy will be placed at the center of the disposal area and the contractor will be required to dump at the buoy. The selection of a site was coordinated with Connecticut Department of Environmental Protection and the Eaton's Neck area was their recommendation.

2. Environmental Setting

a. Socioeconomic Conditions. The town of Greenwich experienced moderate growth of 11 percent during the decade from 1960 to 1970, which was considerably less than the 32 percent population increase of the previous decade. The town's growth in the 1960's was about one-half of that recorded for Fairfield County (21.3 percent) and the State of Connecticut as a whole (19.6 percent). According to the federal census, the town had a 1970 population of 59,755.

Although many residents of Greenwich commute to work in New York City, the town itself is an important manufacturing and business center. In 1970, manufacturing accounted for 44 percent of all employment in the three contiguous Standard Metropolitan Statistical Areas, Stamford (which includes the town of Greenwich), Bridgeport and Norwalk, along Connecticut's western coastal area. The largest industries in this area are electrical equipment, instruments, machinery, and ordnance, producing a wide variety of goods. There has also been a trend toward location of headquarters offices and research laboratories of major industrial and business firms in Greenwich and other coastal cities and towns in southwestern Connecticut.

A well-developed system of highways, including Interstate Route 95 and the Merritt Parkway, provides easy access to the project area from the New York metropolitan region as well as from Connecticut coastal cities and the Hartford area. The location of the Mianus River with respect to major population centers certainly contributes to the very heavy recreational use the harbor receives. Commercial enterprises related to goods and services supportive of recreational boating are thus an important segment of the local economy.

b. Marine Facilities. Located on the Mianus River are six marinas, two yacht clubs, and two boatyards with marine railways and lifts. These facilities occupy essentially all of the land on the west bank of the river between the railroad bridge and the upstream limit of the project at U.S. Route 1. A town marina, overseen by the Cos Cob River Club, is situated in the cove west of the channel between the railroad and Interstate 95.

Based on a recent count, approximately 1,200 boats utilize the Mianus River, most of them recreational craft with drafts up to 6 feet.[1] Half a dozen or so commercial fishing vessels operate out of the harbor, including one clam dragger. The commercial fishing activity as well as commerce in sand and gravel and petroleum have declined in recent years; recreational boating at the present time is by far the most important use of the Mianus River project. Approximately 22,000 recreational vessel trips were reported for 1974.

c. Existing Land and Water Use. Virtually all of the land bordering the Mianus River project area is currently in either residential or commercial use. The water frontage on the westerly side of the Mianus River is occupied exclusively by marinas and boat yards, plus one fresh fish and shellfish establishment and a dock construction firm. Land east of the river and Cos Cob Harbor is zoned residential and development at the allowable densities is basically complete. The town of Greenwich is favored with a long coastline and other good harbors, including Greenwich Cove, Smith Cove, Indian Harbor, Byram Harbor and Greenwich Harbor. The channel and anchorages in Greenwich Harbor are maintained by the federal government.

Recreationally, Long Island Sound and coastal areas are the town's most important assets. Swimming, boating and fishing activities have steadily increased, in some cases to the point of overcrowding the more popular waterfront parks. Attendance at the four town beaches (Greenwich Point, Island, Byram, and Great Captain's) has averaged well over one million visitors annually for the past decade. The demand for mooring space in the town is very high, and it appears that any expansion of boating facilities could be readily utilized. Opportunities for accommodating larger numbers of boats in the Mianus River are fairly limited. The town maintains a small anchorage in Greenwich Cove north of Greenwich Point, where it is possible that additional mooring area could be provided.

In the Mianus River project area, some private dredging work has been accomplished, mainly along the west shore to maintain sufficient depths for boats docking at the marinas. In 1972, 4,700 cubic yards of material were dredged from the berthing area just downstream from the Connecticut Turnpike and transported to the Stamford disposal area, south of the Shippan Point Light Buoy. Clearly, both maintenance of the Mianus River channel by the federal government and periodic dredging of the marina areas by private interests are necessary to insure the continued usefulness and safety of the harbor.

d. Water Quality. The headwaters of the Mianus River are a source of drinking water supply for the town of Greenwich and are thus designated Class AA downstream to the Greenwich Water Company Filtration Plant discharge which is located approximately one-fourth mile downstream from the Stamford-Greenwich city-town line. From the filtration plant to tidewater, the water quality is B_s, indicative of good quality fishable-swimmable waters. The estuarine waters of the Mianus River are classified "SB".

The Greenwich Water Company Filtration Plant has the only wastewater discharges to or near the Mianus River. The plant presently has three wastewater discharges to the river. One consists of filter wash water (200,000 gallons per day) while the other two arise from water treatment sludge disposal (250,000 gpd each). A National Pollutant Discharge Elimination System (NPDES) permit has been issued under Section 402 of the Federal Water Pollution Control Act Amendments of 1972 which established effluent limitations on total suspended solids and aluminum concentrations in these discharges. Other terms of the permit call for elimination of all three discharges before 31 July 1978 by connection to the Greenwich sewerage system.

The Connecticut Department of Environmental Protection routinely collects and analyzes water samples taken from the Mianus River at Palmers Hill Road (downstream from the water filtration plant and at the upstream end of Mianus Pond). Records of analyses since 1967 show uniformly high dissolved oxygen concentrations and low values for phosphate, biochemical oxygen demand, turbidity and other water quality indicators. Gererally, the Mianus River is unpolluted and of good quality from its source to the dam near Post Road (U.S. Route 1).

Available data on the Mianus River estuary suggest that water quality there is not as good as that found above the dam, at least with respect to bacterial contamination. The Greenwich Health Department conducted a water quality survey of the Mianus River during 1975, concentrating on bacterial indicator organisms. Samples were taken at seven different locations, ranging from the Valley Road Bridge near the town line to tidewater just below the Post Road dam. Results of total and fecal coliform counts for the sampling stations located just upstream and just downstream from the dam are tabulated in Table I.

Table I: Data Summary of 1975 Mianus River Survey
by Greenwich Health Department

Date	Total Coliform per 100 ml		Fecal Coliform per 100 ml	
	Above Dam	Below Dam	Above Dam	Below Dam
19 Feb. 1975	20	150	0	210
6 May 1975	100	380	10	360
7 July 1975	0	1600	0	2800
8 Sept. 1975	160	1000	0	500
3 Nov. 1975	110	500	20	0

As can be seen from the table, total coliform counts were significantly higher below the dam than above on all of the dates sampled. The same is true for fecal coliforms on all but the November sampling data. These samples indicate quite conclusively that the Mianus River estuary is being subjected to sources of bacterial pollution that do not affect the fresh water above the dam. In fact, the differences in actual bacterial contamination between the two stations may be greater than the numbers suggest, since survival of coliform organisms in sea water has been shown to be generally lower than in fresh water.[2]

Among the possible sources of coliform bacteria in the lower Mianus River are: (a) sewage wastes from recreational craft, (b) stormwater runoff from adjacent roadways and other areas, and (c) net shoreward movement of lower quality water from Long Island Sound. Discussions with town officials indicate that no pumpout and holding facilities for boat wastes are provided in the Mianus River at the present time.[3] Also, although most of the larger boats have toilets, few have holding tanks for sewage. The likelihood is great, therefore, that untreated or inadequately treated sewage is being discharged from boats using the harbor.

Any stormwater runoff that enters the Mianus estuary from adjacent developed areas may carry with it coliform bacteria picked up from soil, vegetation, and organic debris. Also, discharges from Stamford, Connecticut and Port Chester New York are thought to adversely affect water quality in the Mianus estuary and other coastal waters in the town of Greenwich.[4] This effect may occur due to a net transport of bottom waters, and possibly polluted sediments as well, landward by current and tidal action. Each of the factors described probably accounts for part of the coliform pollution evidenced in the estuary.

The Mianus River was closed to shellfishing about 1971 due to unacceptable coliform levels. According to Connecticut Department of Health rules and regulations governing shellfish, "Areas shall not be considered to meet acceptable standards of purity where such areas are exposed to fecal contamination and where median bacteriological content of samples of water collected from such areas shows the presence of organisms of the coliform group in excess of seventy per one hundred mililiters expressed in terms of most probable numbers in any series of samples collected under various existing conditions."[5]

Recently "seed" oysters have been taken from the Mianus River under a Department of Health permit. Most of these oysters are sold to a commercial dealer in Norwalk, Connecticut, for transplanting to acceptable growing and harvesting areas.

e. Aquatic Ecology and Marine Resources. Although the Mianus River is closed to direct shellfish harvesting, the entire estuarine area is nevertheless highly productive for several species of commercially important shellfish. Eastern oysters (Crassostrea virginica), hard clams (Mercenaria mercenaria), soft-shelled clams (Mya arenaria), and blue mussels (Mytilus edulis) are abundant in Cos Cob Harbor and in the Mianus River upstream to the head of navigation at the U.S. Route 1 bridge.

The Connecticut Department of Health issued one commercial permit in 1975 for taking "seed" oysters from the Mianus River. No detailed studies of productivity and carrying capacity have been conducted for the river; however, it has been estimated that 4,000 to 5,000 bushels of oysters could be taken from the Mianus estuary annually for transplanting purposes.[6] The oysters are transplanted in the approved growing and harvesting areas offshore from Darien to Bridgeport. All of the leased shellfish areas within the Town of Greenwich, 1,049 acres, are presently closed to shellfishing.[7]

Landing statistics for the harbor are not kept by the National Marine Fisheries Service, and commercial landings by the few boats operating out of the Mianus River probably average less than 100 pounds per week.[8] The catch is composed principally of lobsters, with one clam dragger also based in the river.

Finfish resources in the Mianus River estuary and western Long Island Sound are significant mainly because of their recreational value. The sport fishing in the Sound is continually increasing; about 20 percent of Connecticut residents pursue salt water angling, which is a billion-dollar-a-year industry in the state.[9] Striped bass, bluefish, winter flounder, summer flounder, Atlantic mackerel, tautog, and scup are the most important species for the recreational fishery.[10] In addition to these, dogfish, eels, blowfish, black sea bass, butterfish and sea run brown trout are also caught occasionally in the Mianus River area.[11]

The Mianus River has annual runs of river herring (upstream to the dam near Post Road), as do most of the coastal streams on Long Island Sound. Smelt are found in most of the harbors in Greenwich area, and there may be a small spawning run in the Mianus upstream to the dam. Also the estuary serves as habitat for larvae and/or juvenile forms of numerous fish and invertebrate species, including menhaden and many of the sport fish mentioned above.

f. Historical and Archeological Features. The National Park Service's National Register of Historic Places lists no historical sites for the Town of Greenwich, Connecticut. Mr. Finch, the curator of the town's Historical Society, the headquarters of which are located on Strickland Road, Cos Cob, just west of the Mianus River, had no knowledge of any historical or archeological features in or near the Mianus River that might be affected by the dredging project. Therefore, no adverse impacts are foreseen.

g. Rare and Endangered Species. There is no evidence suggesting that any rare or endangered plants or animals, either terrestrial or aquatic, inhabit the project area.

The Atlantic sturgeon (*Acipenser oxyrhynchus*), an endangered species, and shortnose sturgeon (*A. brevirostrum*), a protected species, are both found in Long Island Sound but have not been reported and are not known to occur in the Mianus River area.

h. <u>Possible Dredged Material Disposal Sites</u>. The Eatons Neck disposal area was thought to offer an economical and environmentally acceptable solution to the disposal of dredged material from Mianus River. A proposed disposal site study by the Waterways Experiment Station (WES) was stopped after strong opposition was registered to the experimental aspects by some New York and Connecticut interests. The only other disposal site currently in use that is within an economically feasible haul distance of the Mianus River is the Bridgeport site; however, the Connecticut Department of Environmental Protection has assigned this site for disposal of clean (according to EPA criteria) material only.

Before the Eatons Neck research by WES was terminated, a considerable amount of baseline information was collected on the disposal site, including bathymetric surveys, sediment samples, current measurements, water and sediment chemistry, benthic organism surveys, and phytoplankton data. In contrast, there is essentially no site-specific data on the Bridgeport disposal site. The Connecticut Department of Environmental Protection has indicated that it would object to use of the Bridgeport disposal site for the Mianus River project. The Department considers Eaton's Neck a viable site for disposal of dredged material from projects in western Long Island and Connecticut, because of the knowledge that has been accumulated on the area. Therefore, the dredged material from Mianus River will be disposed of in Eatons Neck.

3. Relationship of the Proposed Action to Land Use Plans

Maintenance dredging in the Mianus River should have little or no effect on land uses and plans in the town of Greenwich or the surrounding region. At the local level, zoning of land on either side of the Mianus River estuary reflects land uses that have developed historically, for the most part, and that are unlikely to change substantially in the foreseeable future. On the east side of the river and Cos Cob Harbor, three residential zones exist: R-12 (12,000 sq. ft. single family) between Post Road and the Penn Central tracks; R-20 (20,000 sq. ft. single family); and RA-1 (1 acre single family). Residential land uses and zoning along the east bank of the lower Mianus River effectively preclude development of additional marine facilities along the Mianus River channel. The strip between River Road and the west bank of the river is zoned B-G (general business). The marinas and a few other commercial establishments intensively utilize this zone, and very little of the land is vacant.

The only vacant or lightly developed waterfront property in the immediate vicinity of the Mianus River project is located (a) in Cos Cob on both sides of Strickland Road west of the river, south of the Connecticut Turnpike and north of the railroad tracks, and (b) south of the tracks, on the site of the Penn Central Transportation Company power plant. Under orders from the U. S. Environmental Protection Agency and the State of Connecticut, this plant is scheduled to cease operations by August 1978. The town of Greenwich as early as 1963 recommended that the two areas described above be acquired and held as public open space.[13] Acquisition of this land at the head of Cos Cob Harbor appears promising, since the town has first refusal for the property at such time as the power plant is closed. The tract is well suited for open space or recreational use. Whether or not the land is acquired by the town, present zoning (residential) would not permit development of marinas or other commercial water-based facilities dependent on access afforded by the Mianus River channel. Therefore, it is not likely that maintenance of the federal project would contribute to or induce further marine-related development in the area of project influence.

On the other hand, failure to maintain the channel in a safe, navigable condition could cause significant changes in land and water use in other parts of town. Reduced accessibility to the Mianus River marinas would put greater pressures on the capacity of other facilities and perhaps lead to new marina construction in less suitable or less desirable locations. The performance of maintenance dredging when and if needed will minimize disruption to land use in the town and the recreational boating segment of the local economy.

Since material dredged from the Mianus River will be disposed of at an approved site in Long Island Sound, no coastal wetlands or any other land areas will be directly affected by the maintenance dredging. Connecticut's Coastal Area Management Program, under the Department of Environmental Protection, is currently in the development stage. One of the long-range aims of the program is the formulation of policies and guidelines for assessing dredging projects on a Long Island Sound-wide basis. Issues include regionalization of disposal sites and timing and sequencing of dredging activities to minimize impacts on estuarine and marine ecosystems. It may be expected that in the future, such a regional focus will be brought to bear more directly on all dredging projects in Connecticut and the north shore of Long Island; however, projects at the present time are evaluated for the most part case by case.

The recently completed Long Island Sound Study contains the recommendation that:

> As part of their coastal zone management programs, New York and Connecticut should strengthen their present memorandum of understanding on dredging, by assigning permanent dredge spoils disposal sites, establishing the quantity of dredge spoils to be dumped at these sites and, together with the Environmental Protection Agency, U. S. Army Corps of Engineers and the National Oceanic and Atmospheric Administration, establish dumping procedures to lessen the environmental harm and monitoring programs to determine the long-term effects of these activities.[14]

The memorandum of understanding referred to is an informal agreement made in 1973 among the States of New York and Connecticut and various federal agencies, to limit dredged material disposal in Long Island Sound to four of an original nineteen historical disposal sites. These were Eatons Neck, New Haven, Cornfield Shoals, and New London.

However, the New Haven disposal site was closed to further dumping because of ongoing research and field studies. The Eatons Neck site was likewise closed to permit predisposal monitoring in connection with research on the environmental impacts of dredged material disposal being done by the Waterways Experiment Station. As mentioned in the preceding Section, this study was terminated in 1975 after strong opposition to the experimental nature of the work was registered by some New York and Connecticut interests. The Bridgeport disposal site was designated as an interim site for clean dredged material as determined on a case-by-case basis.[15]

The State of Connecticut is planning a series of workshops in the spring of 1976 to obtain inputs and concerns of Connecticut residents and the academic and research community with respect to the dredging issues discussed previously. Sponsored by the Coastal Area Management Advisory Group, the meetings should elicit a variety of viewpoints and perspectives on the dredging problem, and serve as an initial basis for guidelines and a statewide policy on dredge and fill projects.

4. Environmental Impact of the Proposed Action

a. Beneficial Impact. Periodic maintenance dredging of the Mianus River is essential if the present intensive usage of the harbor is to continue. Without dredging, shoaling of the channel would ultimately restrict available depths such that only shallow-draft boats would be able to negotiate the river. According to a condition survey of the project in 1974, shoaling is most severe in areas of the channel north of the Connecticut Turnpike where the largest numbers of boats are berthed. Continued shoaling in this section would pose a hazard to navigation, especially with reduced channel widths near the marinas.

Maintenance of adequate project dimensions helps to reduce bottom disturbance and associated turbidity caused by heavy recreational boat traffic, particularly at low tide when minimum depths are encountered. If dredging leads to a reduced incidence of boats grounding or scraping bottom, expenses for hull repairs, repainting and other maintenance would be expected to decline as well.

In 1972 it was reported that there were 100 marinas supplying 5,412 slips and moorings in Fairfield County, Connecticut.[16] These figures are known not to include some smaller marinas in the county and thus do not reflect the total number of available moorings. Nevertheless, the significance of the Mianus River to recreational boating is clear when considering that the project area accommodates around 1,200 boats and probably provides upwards of one-fifth of the total moorings in the county. Since practically all of the coastline in western Connecticut is heavily populated or otherwise committed to commercial, industrial, or recreational uses, it is apparent that recreational boating would suffer without periodic maintenance of the Mianus River. Other intensively utilized marinas would be hard-pressed to meet the boating needs presently served by the federal project, and most likely could not do so without major disruption to present waterfront and land uses.

b. Overview of Dredging and Dredged Material Disposal Impacts. Both the Mianus River estuary and the ocean disposal site will be susceptible to impacts from maintenance dredging activities. At each area, physical, chemical and biological effects are of concern. A dredging operation will result in alterations to the benthic macroinvertebrate communities in and around the dredged area. The most obvious effect will be that of the dredge itself which will result in destruction and/or relocation of most nonmobile organisms and some of the more mobile species of the benthic community in the areas to be dredged. A secondary effect will be caused by smothering elements of the benthic macroinvertebrate community as suspended solids re-settle on adjacent bottom areas. The extent of this impact will depend on the quantity of fines, the prevailing currents and tidal action, and wind activity. Impacts will also vary markedly depending on the species involved, the amount of material deposited, and many chemical and other factors. Certain forms of benthic life can endure heavy siltation (burrowing organisms), whereas other species are less tolerant of sediment. In an estuarine situation such as the Mianus River, however, the benthos are generally well adapted to a wide range of physical environmental conditions. The duration of sediment impacts on the benthic biota will approximate the duration of the dredging operations and will depend on availability of recolonizing organisms. The direct effect on fish populations will be minor for those species which can avoid the dredging operation, while some damage can be expected to less mobile species. Losses of eggs and larvae of fish species, both pelagic and demersal types, may occur due to smothering. Large scale mortalities of immature stages could result.

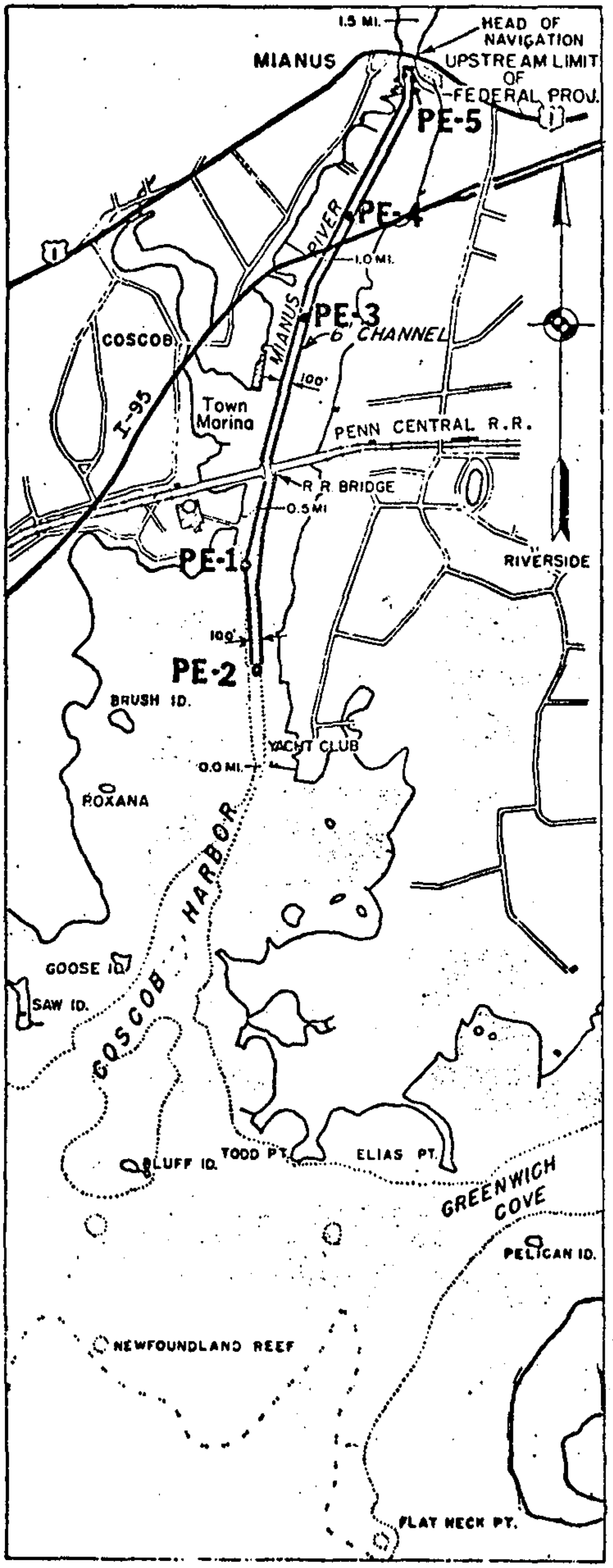
An increase in suspended solids in the estuary will decrease light penetration, thus having an inhibitory effect on photosynthesizing plants in the areas affected. A temporary decrease in primary production may result, although the exposure of nutrient-rich sediments may add nitrogen and phosphorus to the water column and enhance phytoplankton growth. Return to ambient turbidity conditions can be expected shortly after dredging ceases, but the nutrient increases may be longer lasting.

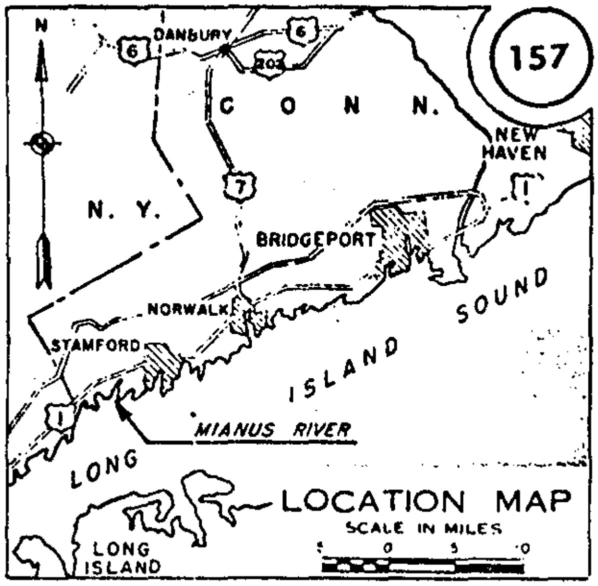
The dredging operation will resuspend material having a high biochemical oxygen demand (BOD) and which may contain concentrations of toxic elements such as heavy metals. Increased BOD will cause some degree of oxygen depletion in areas surrounding the operation. The resulting low oxygen levels may be sufficient to produce stress in portions of the animal community. The concentrations of toxic elements released may be sufficient to have lethal or sublethal effects on the biota. Sublethal effects could involve abnormalities in reproduction or feeding behavior resulting in substantial losses of local populations. BOD and toxic element increases are not easily predictable and will be influenced by a host of environmental variables.

The impacts of dredged material disposal will be much similar to those discussed for the dredging operation. An important concern regarding the selection of a material disposal site is to ensure that the material dumped is similar, at least physically, to the bottom type already present, as recommended at the First Annual Ocean Disposal Conference held at Woods Hole, Massachusetts, in February 1971. This would ensure that a community similar to that already established would re-establish after the dumping operation had ceased, thus minimizing the possibility of major long-term alterations to the biota of the disposal site. If this concern is not met, the newly deposited sediment may be slow to be recolonized as there may be insufficient recruitment populations in the immediate area of a type adaptable to the new substrate.

c. Analysis of Bottom Sediments. Three types of analyses have been performed on sediment samples collected from five separate stations in the Mianus River: (a) grain-size distribution and visual classification, (b) bulk chemical analyses, and (c) elutriate or "shake" tests. Approximate locations of the five stations are shown on Figure 2.

Table II summarizes the physical characteristics of sediment samples from the Mianus River. Station PE-2 is located at the seaward limit of the federal project and the others progressively landward, with PE-5 at the head of navigation. The high percentage of sand at Station PE-5 is probably indicative of the seaward transport of finer-grained material by freshwater flow over the dam at U.S. Route 1. The predominance of silt and clay-sized particles at the other stations is fairly typical of the upper reaches of harbors and estuaries. In the Mianus River, inputs of silt from upland sources are not very large, especially because of sedimentation behind the dam at the head





BRIDGE CLEARANCE
NY NH & H R R BRIDGE (BASCULE)
Hor. 67.5 ft
Vert 20 ft M H W

Figure 2: Location of Sediment Sampling Stations

MIANUS RIVER, CONN.

30 JUNE 1973

IN 1 SHEET SCALE IN FEET
1000 0 1000 2000

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

Table II: Physical Characteristics of Mianus River Sediments
(Samples taken 19 March 1975, analyzed June 1975)

	PE-2	PE-1	PE-3	PE-4	PE-5
Sand Fraction (percent retained on No. 200 U.S. Standard Seive)	14	28	4	1	64
Visual Classification	dark grey organic silt (OH) w/small shells & marine odor	black fine sandy organic silt (OH) w/ small clams & shell fragments & marine odor	black orgonic silt (OH) w/small shells & shell fragments & marine odor	black organic silt (OH) w/ marine odor	dark grey silty medium to fine sand (SM) w/few shell fragments & marine odor

of the channel. (Grain-size curves are found in Appendix A.)

Results of bulk chemical analyses of sediment samples are summarized on Table III. The volatile solids and chemical oxygen demand values are quite high, suggesting that the sediments contain a considerable amount of organic matter. The oil and grease content is also relatively high, which is possibly related to heavy boating and the use of various petroleum products in or near the channel, or perhaps to highway drainage as well. The average mercury concentration for all stations, 0.82 mg/kg, slightly exceeds the value of 0.75 mg/kg in the solid phase as set forth in the Environmental Protection Agency's 15 October 1973 ocean dumping criteria.[17] Cadmium concentrations at all locations are several times higher than the 0.6 mg/kg criterion established by EPA. Based on the values in the table, it can be seen the concentrations for all heavy metals tested are quite consistently lower at a sediment depth of 1.0-1.17 feet than at the sediment surface (0-0.17 ft.), except for Station PE-4 where most metals exhibit increasing concentration with depth.

Table III: Chemical Analysis of Mianus River Sediment Samples*

Parameter	Station Number									
	PE-2		PE-1		PE-3		PE-4		PE-5	
Sample Depth (ft.)	0.0-0.17	1.0-1.17	0.0-0.17	1.0-1.17	0.0-0.17	1.0-1.17	0.0-0.17	1.0-0.17	0.0-0.17	1.0-1.17
Volatile Solids	63,700	52,200	136,000	132,100	103,500	97,300	97,200	105,500	98,600	17,100
Chemical Oxygen Demand	97,300	-	172,000	-	148,000	-	126,000	-	140,000	-
Total Kjeldahl Nitrogen	169	-	3,180	-	3,600	-	3,040	-	2,960	-
Hexane Soluble Oil and Grease	750	-	4,460	-	3,280	-	2,460	-	3,150	-
Mercury	0.76	0.52	0.88	0.75	1.1	1.1	0.62	1.5	0.65	0.34
Lead	102	49	171	74	169	135	183	246	370	93
Zinc	172	61	242	145	331	300	272	381	324	86
Arsenic	8.3	6.1	31	31	7.5	6.2	9.9	7.2	8.3	1.2
Cadmium	49	20	5.7	2.1	6.0	5.2	5.7	7.1	4.6	2.1
Chromium	65	32	5.6	4.1	133	114	103	156	111	21
Copper	95	20	157	124	229	181	189	234	213	31
Nickel	25	49	57	66	96	41	69	57	74	31
Vanadium	73	49	76	50	96	82	69	57	74	13

*Concentrations expressed in mg/kg on a dry weight basis.

The Connecticut Department of Environmental Protection has compared bulk analysis results for ten maintenance dredging projects in the state, including the Mianus River.[18] A rank of from 1 to 10 was assigned to the projects for each of the following parameters: volatile solids, total Kjeldahl nitrogen, oil and grease, chemical oxygen demand, mercury, lead, and zinc. Average contaminant levels from sediment analyses were used in the comparisons. Ranking for the ten projects, based on the sums of ranks for the seven constituents tested, proceeding from "most polluted" to "least polluted", was as follows: Stamford, West River, Norwalk, Branford, Mianus River, Guilford, New Haven, Milford, Housatonic River, and New London. This type of comparison does not distinguish among the several parameters as to their probable water quality or ecological significance. However, it does suggest that overall sediment quality in the Mianus River is neither exceptionally poor nor especially good in comparison with other harbors in Connecticut.

Inferences concerning the effects on water quality of dredging and dredged material disposal cannot be made on the basis of chemical oxygen demand, volatile solids, Kjeldahl nitrogen, oil and grease, and other bulk analysis parameters. In general, little or no relationship is likely to exist between environmental impact of a particular dredged sediment and a particular numerical value for any of these parameters.[19] The bulk analyses for heavy metals or other constituents do not alone give any indication of the availability of the metals to marine organisms and the potential for concentration up a food chain. To supplement the bulk analysis data, elutriate tests were also performed on Mianus River sediment samples using water from the Eatons Neck disposal site. Results are shown on Table IV on the following page.

Table IV: Elutriate Test Results

New England Division, Corps of Engineers, U. S. Army
Report of New England Division, Materials Testing Lab
Water and Sediment Testing
Mianus River, Conn. and Eatons Neck Dump Ground, Long Island Sound
June 1975

Results of tests performed: (1) the standard elutrient resulting from the "shake test" using 1 part bottom sediment from various sampling locations with 4 parts water from the dumping ground and (2) the virgin water from the dumping ground are as follows:

Test Property	Dumping Ground Water (EW-1-75)	Standard elutrient designation and depths of sediment used in shake test: PE-1-75 0-2"	PE-1-75 12-14"	PE-2-75 0-2"	PE-2-75 12-14"	PE-3-75 0-2"	PE-3-75 12-14"	PE-4-75 0-2"	PE-4-75 12'14"	PE-5-75 0-2"	PE-5-75 12-14"
Nitrite (N), mg/l	<0.010	<0.010	<0.010	0.011	0.014	<0.010	<0.010	<0.010	<0.010	<0.010	0.011
Nitrate (N), mg/l	0.12	<0.10	0.13	<0.10	<0.10	<0.10	0.11	<0.10	0.11	<0.10	0.11
Sulfate (SO4), mg/l	1,350	1,350	1,200	1,400	1,100	1,000	1,100	1,150	1,150	1,450	1,150
Freon Soluble, mg/l	1.7	3.1	4.7	2.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
Phosphorus (P)											
ortho, mg/l	0.050	0.025	0.130	0.030	0.500	0.035	0.220	0.125	0.200	<0.010	0.010
Total, mg/l	0.065	0.055	0.185	0.065	0.500	0.080	0,330	0.170	0.470	0.040	0.075
Mercury (hg) ug/l	0	0	0	0	0	0	0	0	0	0	0
Zinc, (Zn), ug/l	15	9	4	6	13	5	4	6	10	7	5
Lead, (Pb), ug/l	<5	<5	<5	<5	7	<5	<5	<5	<5	<5	<5
Arsenic, (As), ug/l	0	10	14	9	40	14	20	14	17	6	23
Cadmium (Cd), ug/l	1	<1	<1	2	1	<1	<1	3	5	3	1
Chromium (Cr), ug/l	<3	<3	3	3	<3	<3	3	<3	3	<3	<3
Copper, (Cu), ug/l	9	5	8	9	7	4	3	5	3	4	8
Nickel (Ni), ug/l	<3	<3	<3	<3	<3	<3	<3	<3	<3	5	3
Vanadium (V), ug/l	<10	20	20	15	35	<10	<10	<10	<10	<10	<10

NOTES:
1. All tests performed by NED laboratory personnel in accordance with accepted EPA procedures.
2. Reference is made to paragraph 227.61(c), Federal Register dated October 15, 1973, Volume 38, Number 198, Part II, EPA, Ocean Dumping, final regulations and criteria which states "Dredged Material may be classified as unpolluted if it produces a standard elutrient in which the concentrations of no major constituent is more than 1.5 times the concentration of the same constituent in the water from the proposed disposal site used for testing."

Table V: Summary of Parameters and Stations
Violating Elutriate Test Criterion

Parameter	1.5x criterion exceeded by standard elutrient from stations:
Freon soluble	PE-1
Phosphorus (P)	
Ortho	PE-1, PE-2, PE-3, PE-4
Total	PE-1, PE-2, PE-3, PE-4
Arsenic	PE-1, PE-2, PE-3, PE-4, PE-5
Cadmium	PE-2 PE-4, PE-5
Vanadium	PE-1, PE-2
Other parameters measured	None in excess of criterion

Table V shows a brief summary of the parameters at various stations whose levels were found to exceed 1.5 times the concentration of the same constituent in the water taken from the Eatons Neck disposal site.

Only arsenic was found to violate EPA's elutriate test criterion in samples from all five stations. However, it is not apparent that arsenic levels are cause for serious concern over water quality impacts during dredged material disposal. The Committee on Water Quality Criteria suggested, on the basis of freshwater and marine toxicity data available, "that concentrations of arsenic equal to or exceeding 0.05 mg/l constitute a hazard in the marine environment."[20] The greatest concentration of arsenic measured in the standard elutrients was only 0.04 mg/l, and it would be reasonable to expect that substantial dilution during any open-water disposal operation would further reduce these concentrations. Similarly, cadmium at concentrations equal to or greater than 0.01 mg/l is thought to be hazardous,[21] but the highest value from the elutriate tests was 0.005 mg/l (even though three of the samples cannot be classified as unpolluted with respect to cadmium, based on the elutriate test). The above comparisons to well documented water quality criteria along with the elutriate test results provide little evidence to indicate that the release of heavy metals from the dredged material will present a significant threat to disposal site water quality and resident marine biota.

d. Probable Impacts of Dredging on the Mianus River Estuary. Although numerous species of benthic invertebrates and finfish can be found in the Mianus River, impacts on those shellfish that have existing or potential commercial value warrant considerable attention. It has been reported, for example, that one bushel of seed oysters, at maturity, can provide anywhere from four to ten bushels of market oysters, depending on location and other factors. The following sections discuss probable environmental impacts of dredging in the Mianus River, with regard to both shellfish and other environmental resources.

(1) Effects of Turbidity and Siltation. Many investigators have shown that adult oysters are conspicuously tolerant to siltation and turbidity. Sherk and Cronin[22] in their extensive literature review of sedimentation effects on estuarine organisms consistently found oysters to be "remarkably silt tolerant." Both the hard clam and soft clam are active burrowers and are thus not especially susceptible to damage from the levels of turbidity and amounts of siltation that would result from maintenance dredging.

Dunnington[23] conducted laboratory burial experiments on oysters from the Patuxent River, Maryland. These experiments entailed burial of oysters three inches deep in a sand/mud mixture and observations made in running sea water at five temperature ranges from less than 5°C (41°F) to more than 25°C (77°F). He noted that soil conditions in which the oysters were buried were similar to their natural bottom habitat; one inch below soil-surface interface was aerobic but at two inches deep, soil was mostly anaerobic and at three inches deep, conditions were entirely anaerobic. From his experiments, he concluded that there was an inverse relationship between survival time and temperature. Oysters buried in summer temperatures (15-20°C) survived for one week but all died within two weeks. Under winter temperatures (around 5°C) oysters lived for over five weeks and complete arrestation did not occur until after 10 weeks.

Natural background turbidities in an estuary can vary over a wide range, and may more than double from natural causes during a tidal cycle.[24] Estuarine species are thus well adapted to recurrent high concentrations of suspended solids and siltation. Turbidity increases caused by operation of a mechanical bucket or clam shell dredge will, for the most part, be localized in the vicinity of the dredge and of fairly short duration. Embryonic and larval stages of oysters, other shellfish and finfish tend to be more sensitive to turbidity than adults. Loosanoff[25] found that 39 percent of oyster larvae completed development in a suspension of 2 grams of dry silt per liter of sea water, but none survived in 3 g/l. However, some adverse effects on the survival of early life stages were noted at sediment concentrations as low as 125 mg/l.

The dam across the Mianus River obstructs the upstream movement of anadromous species. An annual run of alewives (Alosa pseudoharengus) and/or blueback herring (A. aestivalis) in the lower Mianus River is reported, however, with spawning probably taking place near the uppermost limits of the dredged channel. These species may exhibit an avoidance reaction and fail to enter the Mianus estuary in the spring spawning season if turbidities are high because of dredging operations. In addition, lower salinities caused by freshet flows can reduce the resistance of estuarine species; thus dredging at that time may contribute substantially to stress on the estuarine ecosystem.

(2) Effects of Heavy Metals. A considerable amount of work has been done on the accumulation and effects of heavy metals in shellfish. Pringle *et al.*[26] illustrated the capabilities of three species of bivalve mollusks (*Crassostrea virginica*, *Mya arenaria*, and *Mercenaria mercenaria*) to concentrate various heavy metals against a concentration gradient. Their work showed individual species differences in abilities to concentrate heavy metals and also differences in abilities of organisms to remove toxic elements. The effect of biological magnifications is shown again in work by Hardisty *et al.*[27] who found a significant correlation between the cadmium concentrations in the tissues of selected fish species and the proportions of crustaceans in the diet. A similar trend was found for levels of lead.

Kopler[28] exposed oysters (*C. virginica*) to specific environmental levels of inorganic, phenyl- and methyl-mercury, and found that continuous exposure to any of the three compounds at a level of even 1 mg/l mercury resulted in tissue concentrations far in excess of the 0.5 ppm guideline established by the Food and Drug Administration. Mercury concentrations in the tissues of adult oysters exposed to 10 mg/l mercury (as mercuric acetate) were found by Cunningham and Tripp[29] to average 28 mg/kg after 45 days' exposure. Total purification of heavy metals was not achieved over a six-month cleansing period. Calabrese, et al.[30] in working with oysters (C. virginica), evaluated the toxicity of various heavy metals to oyster embryos. A summary of results of their research, carried out at the National Marine Fisheries Service Biological Laboratory in Milford, Connecticut, is given in Table VI. Mercury, copper, and zinc are shown to adversely affect oyster embryo survival at fairly low concentrations, whereas such elements as arsenic and chromium appear to be considerably less toxic.

Table VI: LC_{50}* Concentrations of Heavy Metals for Oyster (C. virginica) Embryos, 24-48 Hour Exposure

Most Toxic		Less Toxic		Relatively Nontoxic	
Metal	LC_{50} Conc. (ppm)	Metal	LC_{50} Conc. (ppm)	Metal	LC_{50} Conc. (ppm)
Mercury	0.0056	Nickel	1.18	Arsenic	7.5
Silver	0.0058	Lead	2.45	Chromium	10.3
Copper	0.103	Cadmium	3.80	Manganese	16.0
Zinc	0.31			Aluminum	7.5

*LC_{50} refers to the concentration of a substance that causes mortality in one-half of the test organisms in a specified time of exposure, in this case 24-48 hours.
Source: Calabrese, et al., op.cit.

(3) Probable Magnitude and Extent of Impacts. The total area of the Mianus River channel is around 16 acres, from its outer limit in Cos Cob Harbor to the head of navigation. At the time of the 1974 condition survey, the area with depths shallower than six feet below mean low water totaled less than 3 acres, with shoaling principally along the eastern side of the channel upstream from the railroad bridge. Unless conditions change considerably prior to maintenance dredging, 50 percent or less of the channel area north of Interstate 95 would need to be dredged, and only about one-fifth of the channel area between I-95 and the railroad bascule bridge. An average of about 2 feet of material has to be removed from the areas described.

Losses of shellfish and other benthic invertebrates will occur in direct proportion to the extent of dredging. As is evident from the previous paragraph, shoal areas constitute a fairly small fraction of the total project. Benthos, which inhabit only the topmost sediment layer, will thus be largely destroyed over an area of no more than the few acres where dredging is to be done. The bottom that is subjected to major disturbance will be rendered less suitable for the following year's spat setting due to the removal of shell fragments (cultch). (Spat setting can occur on a variety of substrate types with differing degrees of success, but a shell-covered bottom is a preferred habitat.) Recolonization will likely occur quite rapidly due to the abundant recruitment of populations from adjacent flats and undredged channel areas.

The intertidal community will be susceptible basically to the indirect effects of dredging: short term siltation, temporary reduction of dissolved oxygen, possible release of heavy metals, and other effects on water quality. Impacts due to settling of matter suspended during dredging will not be significant as long as large scale burial does not result. This occurrence is very unlikely since a clam shell dredge can operate so as to remove sediments at a density approaching the *in situ* density with a minimum of disturbance. The release of heavy metals from sediments upon dredging is an extremely complex process, affected by numerous environmental variables including pH, dissolved oxygen, chemical characteristics of the interstitial water, physical and chemical states of the metals, sediment grain size, and others. Heavy metal concentrations will not necessarily increase in the dredging area, and in some cases have been found to decline due to adsorption onto suspended silt and clay particles.[31] The organic fraction of the Mianus River sediments, as approximated by volatile solids measurements, is quite high, averaging 90,300 mg/kg with a maximum of 136,000 mg/kg on a dry weight basis (see Table III). Under undisturbed conditions, oxygen is removed very slowly by the bottom sediments, and then only by the surface layers. Upon dredging and exposure of anaerobic sediments, reduced chemical compounds will exert an immediate oxygen demand on overlying waters while biological degradation or organic matter will also require oxygen although at a lesser rate. Therefore, some depletion of dissolved oxygen may be experienced in the harbor while the maintenance dredging is underway. Circulation in the estuary, the magnitude of freshwater inflows, and other factors will influence the severity of oxygen deficiencies. If anaerobic conditions occur, the release of hydrogen sulfide and associated unpleasant odors may be expected.

(4) Mitigation Considerations. In view of the preceding description of potential environmental impacts associated with Mianus River dredging, the issues of scheduling and timing are key to avoiding or minimizing adverse effects. Table VII following summarizes the spawning characteristics and habits of several species of fish and shellfish that are important to, and found in, the Mianus River area. It is clear that the estuary provides essential habitat for spawning and development of these and other species. The Connecticut Department of Agriculture, Division of Aquaculture, generally holds that dredging in estuaries having important shellfish resources should not take place during the period of shellfish spawning and spat setting, generally mid-June through late August in the Mianus River. In the case of maintenance dredging of the Housatonic River, also an important growing area for oysters, the Corps of Engineers agreed to commence maintenance dredging after 1 October. Because most estuarine and marine species in the Mianus River area will have completed spawning and passed the critical stages of development by this time, autumn or early winter dredging would probably have less ecological impact than would dredging in other seasons. Also, reduced water temperatures would mitigate the impacts of any short-term changes in

water quality originating from dredging.

The importance of the Mianus River estuary to spawning of various finfish species is not known in quantitative terms; presumably the winter flounder and other spring spawners utilize the area to some extent. The alewife run in the Mianus River may pose a constraint to spring dredging; however, water temperatures sufficient to induce spawning of alewives (55-60°F) are usually not attained until mid- or late April, with peak spawning runs probably not occurring until some time in May. Dredging in early spring prior to this period would thus have little impact on the species.

The question of timing also relates to recreational use of the project. Obviously, dredging operations during the summer could cause some inconvenience to boaters, particularly when the dredge and scows are working in the channel adjacent to the marinas, where access could be temporarily impeded. Also, turbidity and perhaps odors resulting from bottom disturbance may be considered as temporary aesthetic impacts. Maintenance dredging in the off-season would minimize disruption to recreational boating interests in the harbor.

Table VII: Spawning Characteristics of Several Important Mianus River Estuarine Species

Species	Spawning Time/ Temperature	Remarks
Oyster *Crassostrea virginica*	Late June-August commences after water temperature reaches 68° -70°F	Planktonic stage may last 2-3 weeks before setting. Peak setting early July to early August
Hard Clam *Mercenaria mercenaria*	Mid-June - Mid-Aug., water temperature 68°F	Similar to above
Soft-shelled Clam *Mya arenaria*	June-August	Similar to above
Menhaden *Brevoortia tyrannus*	Spawns in open ocean	Larvae migrate to estuaries in spring, juveniles return to ocean late summer & fall
Alewife *Alosa pseudoharengus*	Water temperatures 55°-60°	Larvae/juveniles grow in estuaries
Winter Flounder *Pseudopleuronectes americanus*	Late winter and spring in shallow bays and estuaries	Eggs sink and hatch in 15-18 days at 37°F. Larvae/juveniles stay in estuary more than a year

e. Probable Impacts of Dredged Material Disposal in Long Island Sound.

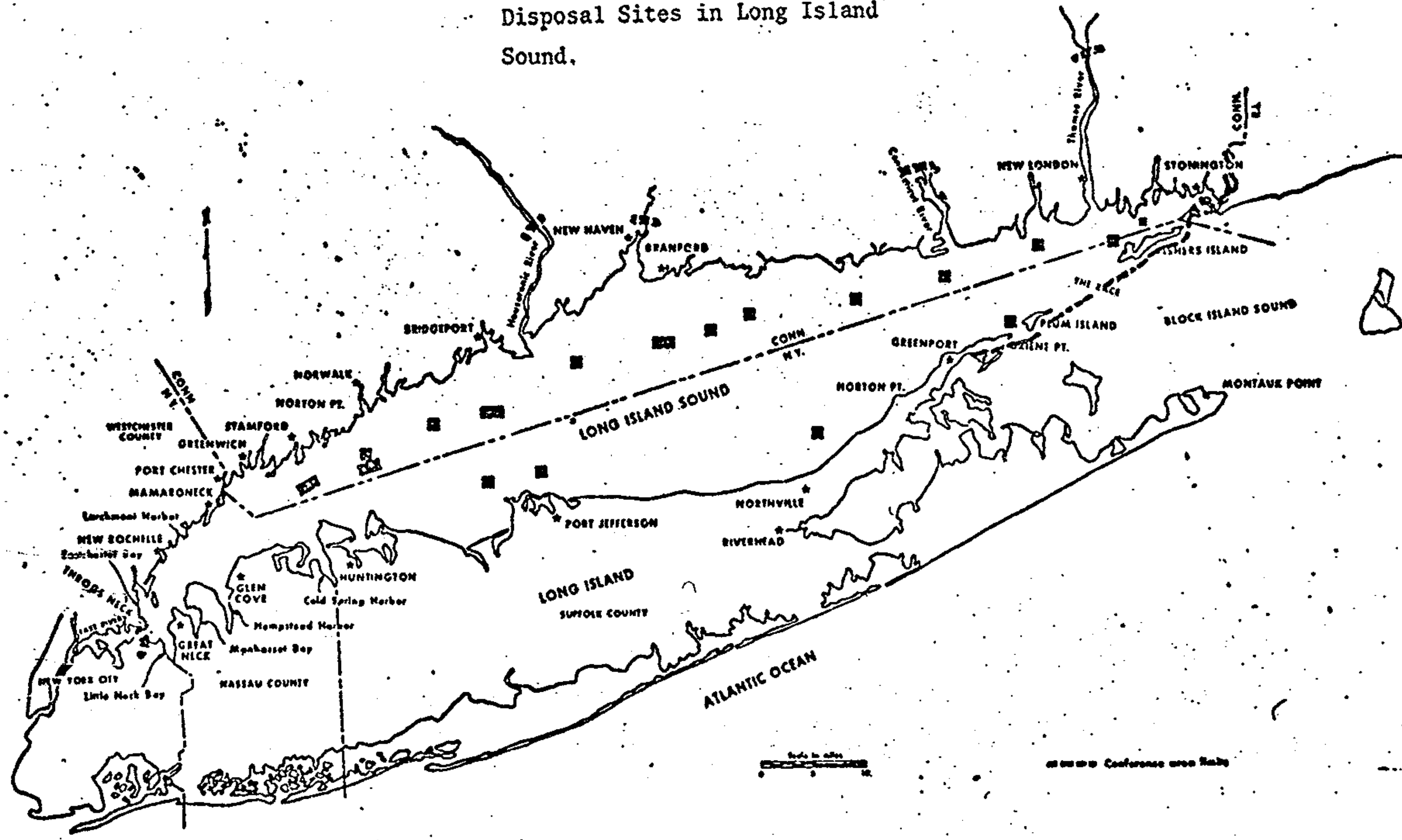
One of the historic disposal sites in western Long Island Sound is probably more desirable, at least on an interim basis, than committing a new area to receive dredged material.

Both short-term and long-term impacts can result from dredged material disposal. Short-term impacts, occurring within the approximate time period when disposal is accomplished, will be qualitatively similar to those discussed with respect to the dredging operation. That is, effects on water quality, burial or smothering of benthic organisms, and perhaps indirect damage to marine biota due to changes in water chemistry can be expected to occur at the disposal site as well. In the longer term, impacts may be cumulative. Considering just the Mianus River project, it is doubtful that disposal once every decade or so of the relatively small quantities of material involved would have appreciable long-range impacts on any one disposal site. However, disposal of dredged material from the numerous federal, local and private dredging projects in western Long Island Sound becomes significant in a regional context.

Very little site-specific information has been collected on dredged material disposal sites and disposal operations in the western part of the Sound. Fortunately, most of the predisposal baseline studies of the Eatons Neck area were completed by the Corps' Waterways Experiment Station and researchers before the project was terminated. As a result, physical, oceanographic, biological, and water quality characteristics at the Eatons Neck site can be described in considerable detail, in contrast to the lack of specific data on other sites within an economical haul distance from the Mianus River.

Figure 3 shows the locations of dredged material disposal sites in Long Island Sound. Numerous factors are thought to be relevant in selecting a disposal site. Among them are: (1) the degree of containment or dispersal afforded (which in turn depends on currents, bathymetry, and other characteristics),

FIGURE 3: Historical Dredged Material Disposal Sites in Long Island Sound.



(2) the types and amounts of dredged material requiring disposal, (3) location, (4) biotic productivity, and (5) significance of the site with respect to commercial and/or recreational fishing or shellfishing. It does not appear that sufficient information is available on potential disposal sites in western Long Island Sound to distinguish among them on the basis of the above factors. It is very difficult to locate an area that is not subjected to reasonably heavy fishing pressure. For example, Figure 4 illustrates the ubiquity of lobsters in the Sound, and Figure 5, important commercial fishing areas. Choice of a disposal area should, nevertheless, include full consideration of all information on commercial and recreational fishing and nursery areas. In addition, there is a need for site-specific information on bottom topography and type, oceanography, and benthic ecology for possible disposal areas so that informed decisions can be made. Generally, sediments from harbors in western Connecticut have tended to be finer-grained and more "polluted" than dredged material from more eastern locations. Under these circumstances, it may be desirable to locate a disposal site that favors containment, rather than dispersal, of dredged material, in accordance with the recommendations made at the first ocean disposal conference held in Woods Hole, Massachusetts in February 1971. Site selection based on this rationale cannot be done without further physical and oceanographic studies. Also, in order to gain a more quantitative understanding of the impacts of dredged material disposal, it would seem prudent to conduct long-term monitoring of disposal operations at a regional site.

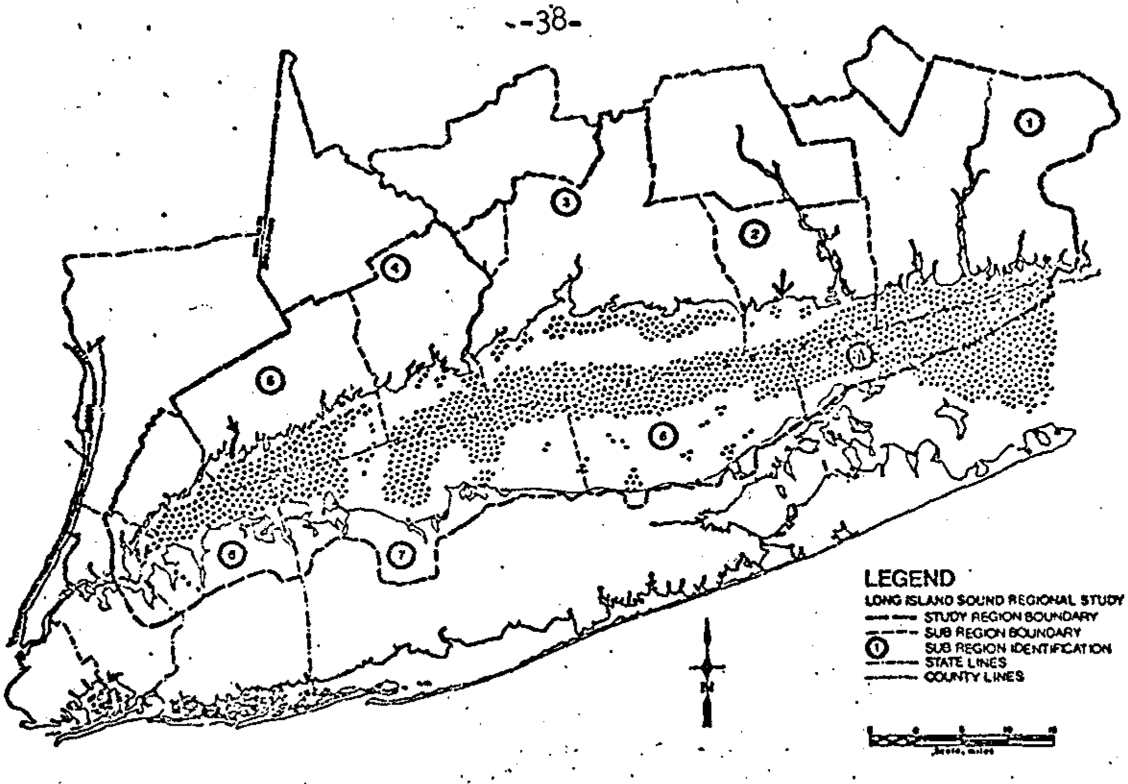
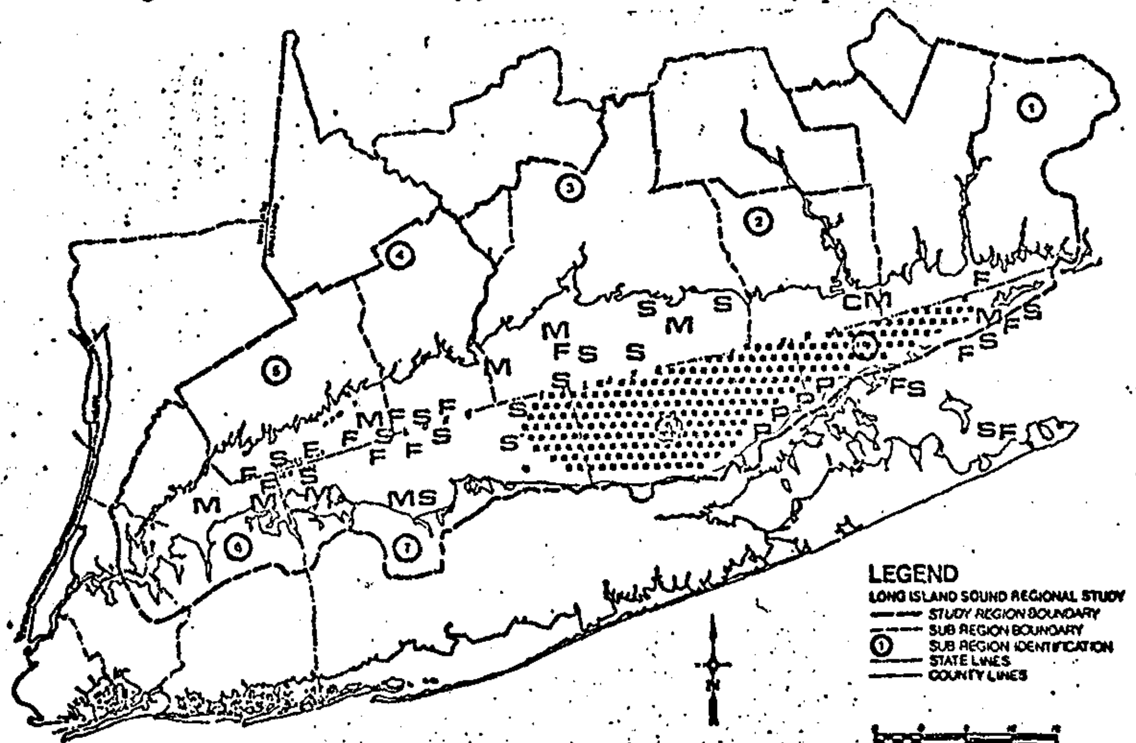


Figure 4: Lobster Concentration Areas in Long Island Sound
Source: Long Island Sound Study, Fish and Wildlife, p. 24.



P Pound net fishery
⁘ Otter trawl fishery
S Scup fishery
F Flounder fishery
C Connecticut River shad and alewife fishery resource
M Menhaden fishery

Figure 5: Descriptive and Historical Commercial Finfisheries in Long Island Sound
Source: Long Island Sound Study, Fish and Wildlife, p. 56.

5. Probable Adverse Environmental Impacts Which Cannot Be Avoided

Maintenance dredging in the Mianus River will entail destruction of shellfish and other benthic organisms in the upstream portion of the channel, from an area of perhaps three or four acres. These losses are essentially unavoidable and will depend, in future maintenance operations, on the extent of shoaling in the channel. Indirect impacts on organisms inhabiting tidal flats adjacent to the project and subtidal waters in the harbor will also be incurred as a result of dredging. Turbidity and siltation in the estuary will produce temporary stress on the benthic and planktonic communities, but major impacts are not anticipated because of the abilities of estuarine species to withstand highly variable and unstable ambient conditions. Bottom habitat in affected areas will be less than optimum for shellfish larvae attachment until recolonization takes place. Bacterial decomposition of exposed and suspended organic matter will cause a decrease in dissolved oxygen concentrations and possible production of hydrogen sulfide, particularly at the sediment-water interface. Heavy metal levels in the overlying water may or may not increase. Odors and turbidity will adversely affect aesthetics in the harbor for the duration of dredging.

Dredged material disposal in Long Island Sound will also result in burial of resident organisms in the immediate vicinity of the disposal site, with progressively less impact on benthic species at increasing distances from the center of disposal. Besides the direct impacts, local bottom topography and substrate characteristics will be changed. Therefore, an effort should be made to dispose of dredged material in areas exhibiting sediments that are similar in composition and compatible with the dredged material. The cumulative impacts of utilizing a regional disposal site cannot be easily estimated.

The build-up of organic matter may contribute to oxygen depletion in the waters overlying the disposal site. Biological reworking of the sediments by deposit-feeders will take place if dumping is not so frequent as to continually eliminate and inhibit the recovery of benthic populations. Species diversity will almost surely be reduced in such a disposal area to those organisms that show greater tolerance to pollution and an unstable substrate. It is probable that commercially or recreationally important species, such as lobsters and other shellfish, and demersal finfish (flounder, for example) would decline in abundance in the area surrounding a regularly used dredged material disposal site.

6. Alternatives to the Proposed Action

The number of alternatives that can be considered to meet criteria of technical and economic feasibility and environmental acceptability is quite small for Mianus River maintenance dredging. Since the dredging operation entails both the excavation of material from the river and the disposal of that material, alternatives for each of these phases are discussed separately.

a. Dredging

Maintenance of the Mianus River channel is essentially a "dredge or no dredge" proposition. Since there are no anchorages involved, opportunities for reducing the scope of the project are limited. Also, access to the northern part of the river is essential because of the concentration of marinas and other boating service facilities there. Since the project was last dredged in 1964, little or no shoaling has been evidenced below the railroad bridge, while in the vicinity of the marinas available depths have been reduced sufficiently to cause inconvenience and pose a potential hazard to navigation of deeper draft vessels. The principal source of congestion and navigation difficulty in the river is apparently not shoaling, but rather the railroad bascule bridge (vertical clearance 20 feet) which has to be operated to allow passage of sailboats. It is not uncommon on summer weekends for several boats to be waiting for the drawbridge, and boats have occasionally run aground.[32]

The question of timing for maintenance dredging of the Mianus River is very important with regard to environmental impacts. Fortunately, the scope of the project is such that work can be accomplished in a relatively short time period. Thus, there is some flexibility in scheduling the project to avoid or minimize adverse environmental effects.

As discussed in Section 4.d(4), June through August is most critical for oysters and other shellfish, since spawning and spat setting normally take place in this period. Also, recreational use of the project is concentrated heavily in the three summer months. Both of these factors strongly suggest the undesirability of summer dredging. In addition, impacts of any temporary lowering of water quality from dredging could be aggravated because of high water temperatures and low freshwater flows that typically occur then.

Recognizing the greater sensitivity of larval and juvenile stages to turbidity, sedimentation, and other effects of dredging, the potential for adverse ecological impacts will probably be minimized if the maintenance is done some time between October and early March.

b. Disposal of Dredged Material

Alternatives involving land disposal of dredged material were not considered in any detail for the Mianus River project because of the lack of feasible land-based sites. Basically, the technical feasibility constraints on such a site are the following: (1) The maximum economic distance to which material could be pumped is 10,000 feet from the dredging site, and (2), the maximum height that the material could be lifted is 30 feet, thus the top of the fill material could be a maximum of about 23 feet above mean low water. In view of existing land uses along the coast in Greenwich, the absence of suitable land sites is understandable. More innovative dredged material disposal techniques, such as the creation of artificial islands or marshes, do not offer practicable solutions to the disposal problem. The small quantities of material that must be dredged are not sufficient for undertaking a project of this type. The building nor island creation is very applicable in Connecticut due to the lack of socially and environmentally acceptable sites.[33]

In essence, some form of open-water disposal is the only viable option for the Mianus River project. The Corps realizes the necessity of examining all dredging activities in Long Island Sound in a comprehensive manner. A possible format and scope for such a regional assessment are currently being discussed with the Connecticut Department of Environmental Protection. A similar regional approach has been taken by the Corps of Engineers in evaluating problems of dredging in the Narragansett Bay-Block Island Sound area. At the same time, the State of Connecticut is proceeding to formulate a Sound-wide policy statement with respect to dredging and dredged material disposal. As earlier mentioned, the views of interested citizens, scientists, and groups will be solicited as inputs to the policy development process.

Both of these efforts should be directed toward resolution of conflicts, problems, and questions about dredging and disposal in the Sound. Fundamental issues include the location of regional disposal sites, what types and amounts of dredged material should be placed in specific sites, how often and when they should be used, the necessity for monitoring programs, and acceptable methods for making these determinations.

7. The Relationship Between Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

Dredging in general involves trade-offs between social and economic benefits on the one hand and environmental impacts on the other. Clearly, maintenance dredging of the Mianus River and other federal as well as local or private projects in western Connecticut entails acceptance of certain adverse impacts, in both dredging and disposal operations. However, these impacts can be minimized by dredging only when and where necessary, by careful timing to avoid critical periods for aquatic biota, and by giving careful consideration to the selection and use of open-water disposal sites. Over the long term, dredged material disposal in Long Island Sound should be re-evaluated periodically in light of research and field results, and policies modified as necessary, to avoid or reduce ecological impacts.

Maintenance dredging of the Mianus River is required on the order of once every twelve years. The dredging itself will result in short-term environmental degradation from turbidity increases, changes in water quality and destruction of marine organisms in the dredging area. Return to predredging ambient conditions can be expected long before dredging is again required, as evident in the past. Presently, the long-term productivity of potentially important shellfish resources in the Mianus River project area is negatively affected by water pollution from various sources. A partial solution is the installation of marine toilet pump-out and waste handling facilities at the Mianus River and other key recreational harbors, as recommended in the summary volume of the study, People and the Sound: A Plan for Long Island Sound. A statewide inventory of facilities and development of a management program for boat wastes are being undertaken by the Connecticut Department of Environmental Protection. Completion of this work plus adequate treatment of point source wastewater discharges to western Long Island Sound should contribute significantly to improving water quality in the Mianus estuary, possibly to the point where the shellfish areas could be reopened. With abatement of pollution from recreational craft using the federal channel and marinas and from other sources, it is reasonable to expect that productive uses of the river for both recreational boating and shellfishing can be enhanced over the long term with little conflict of these uses.

8. Irreversible or Irretrievable Commitments of Resources

The labor and capital necessary to maintain the authorized dimensions of the Mianus River channel represent irretrievable resource commitments. Although not documented or known for certain, it is possible that the stress imposed on the estuarine ecosystem by periodic maintenance dredging causes a decrease in the diversity and/or abundance of organisms in the affected area below that which would occur in the absence of the project. However, there is no evidence to suggest that productivity, at least for shellfish, has been adversely affected by dredging except perhaps for one season following direct losses of benthic organisms.

Recolonization of the dredged area will proceed almost immediately as abundant populations of macroinvertebrates are found in all intertidal and subtidal areas adjacent to the channel. Some direct mortality of benthic or demersal species will be associated with dredged material disposal in Long Island Sound. No irreversible effects due to disposal of dredged material from the Mianus River alone would be expected; however, regular disposal of material from this and other projects at a regional site would subject such an area to continual stress probably resulting in a reduced diversity of marine life.

Land bordering the Mianus River is, in essence, fully committed to a variety of uses, including residential, commercial, and open space. Maintenance of the Mianus River project will not, in and of itself, induce more intensive recreational boating use or secondary development of facilities to accommodate the boating public, since the present development is at or near saturation under existing land use regulations of the Town of Greenwich. It can be expected that project maintenance will ensure continued full utilization of the waterfront property that has been committed to serving recreational boating as well as other uses.

9. Coordination

In preparation of this environmental assessment report, the proposed maintenance dredging of the Mianus River in Greenwich, Connecticut has been discussed and coordinated (orally and/or in written communications) with those agencies, organizations and persons listed below. As a result of these interactions there have been contributions of information to this report which provide a degree of comprehensiveness not otherwise available.

U. S. Government

Environmental Protection Agency, Region I, Boston and Needham, MA

National Marine Fisheries Service, Gloucester, MA and Milford, CT

Corps of Engineers, New England Division, Waltham, MA

Fish and Wildlife Service, Concord, NH

State of Connecticut

Department of Environmental Protection, Hartford and Waterford

Department of Agriculture, Aquaculture Division, Milford

Department of Public Health, Environmental Health Division, Hartford

Town of Greenwich

Harbormaster, Robert Chard

Planning and Zoning Commission, Lee Markscheffel

Health Department, Environmental Health Division, Frank Singleton

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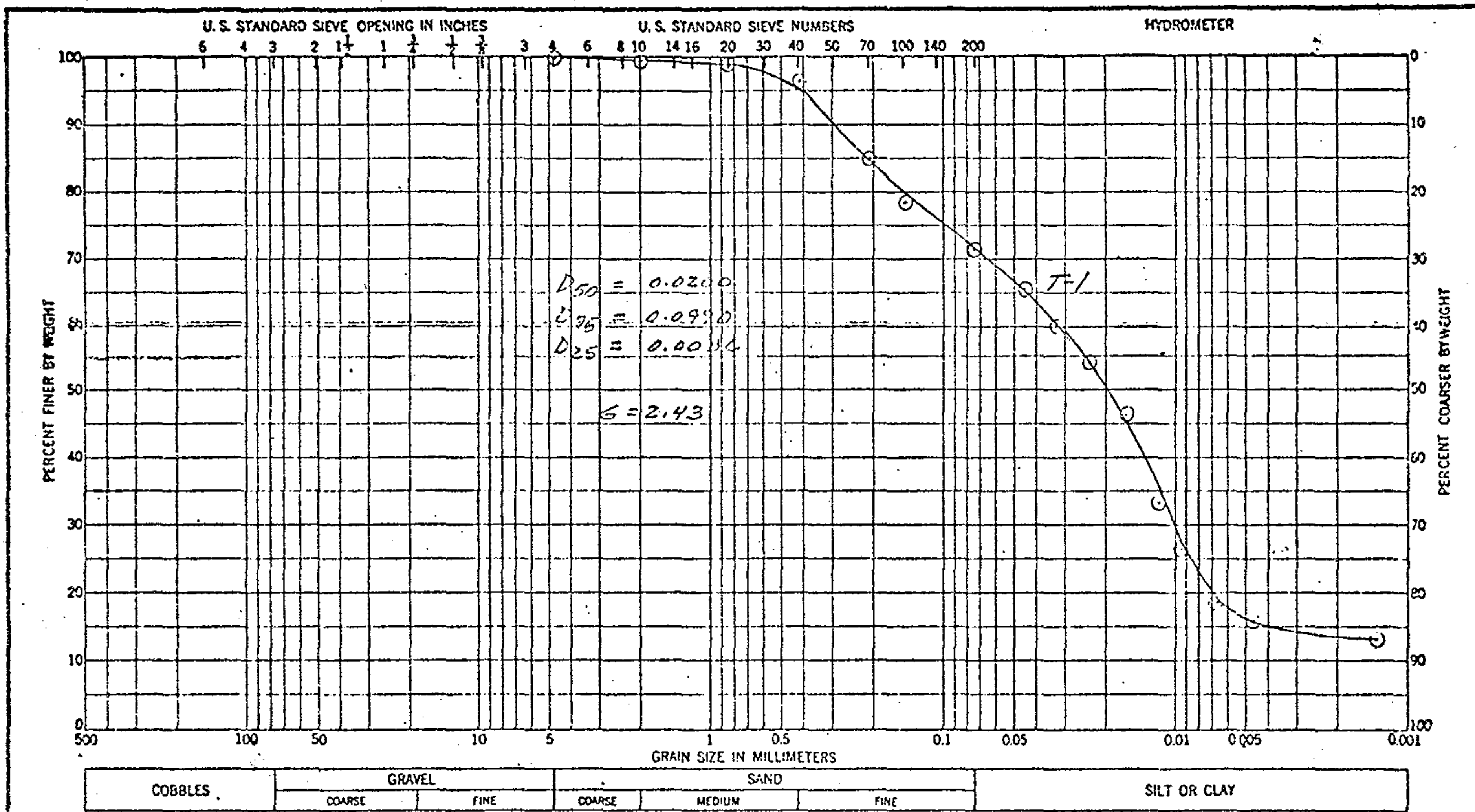
Appendix A: Grain-Size Curves for Mianus River Sediment Samples



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
T-1	0.0'-3.0'	fine sandy ORGANIC SILT (OH)		74 (61)*	48 (47)*	26 (14)*
		* Test run on oven-dried soil				

Project Mianus River, Conn.

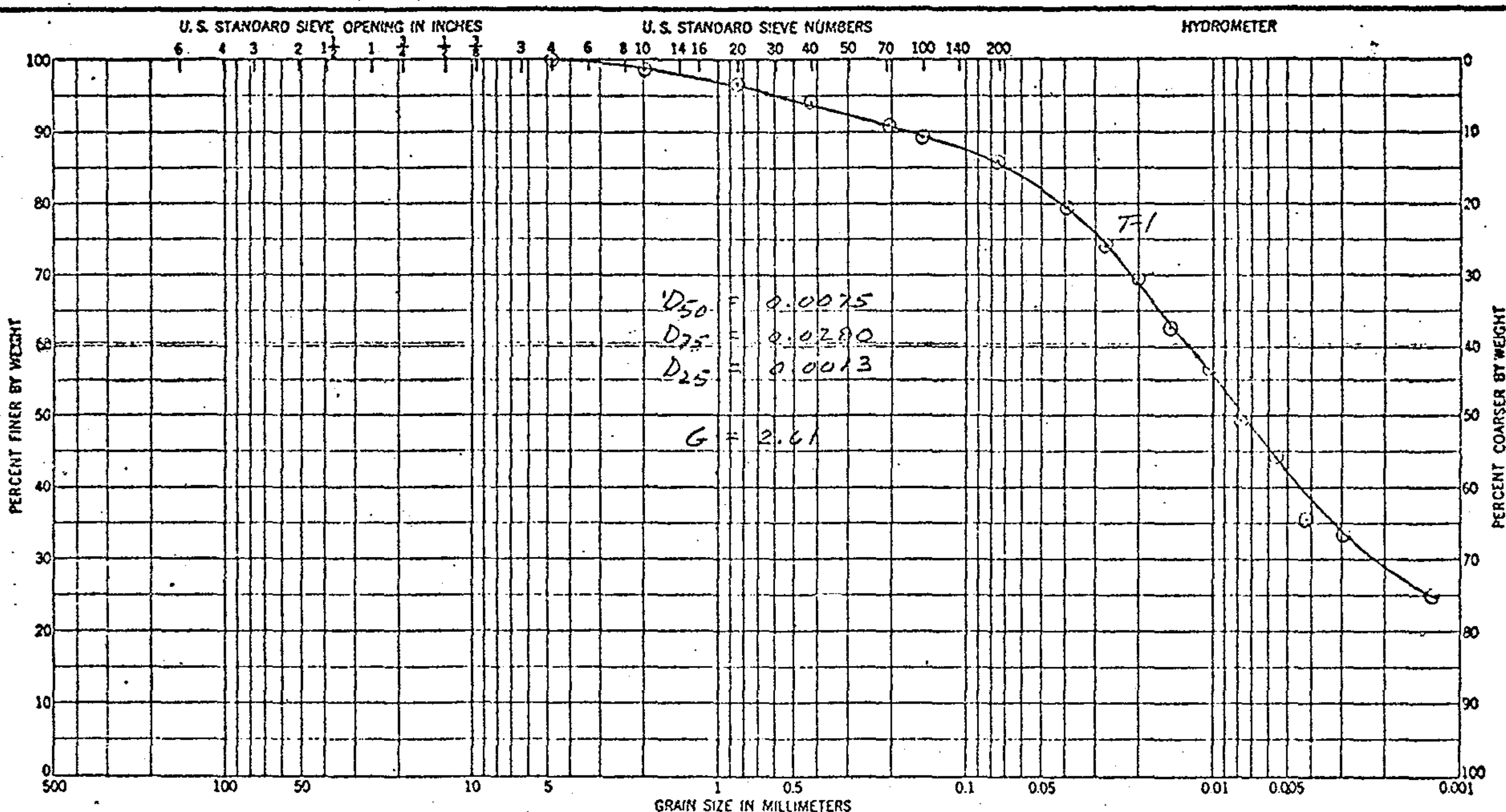
Area

Boring No. PE-1 (Lab. Ser No. 100-185-1)

Date June 1975

GRADATION CURVES

ENG FORM 1 MAY 63 2087



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
T-1	0.0'-1.4'	Fine sandy ORGANIC		(66)*	(36)*	(30)*
		SILT (OH)		82	41	41
		*Test run on oven-dried soil				

Project: Mianus River, Conn.

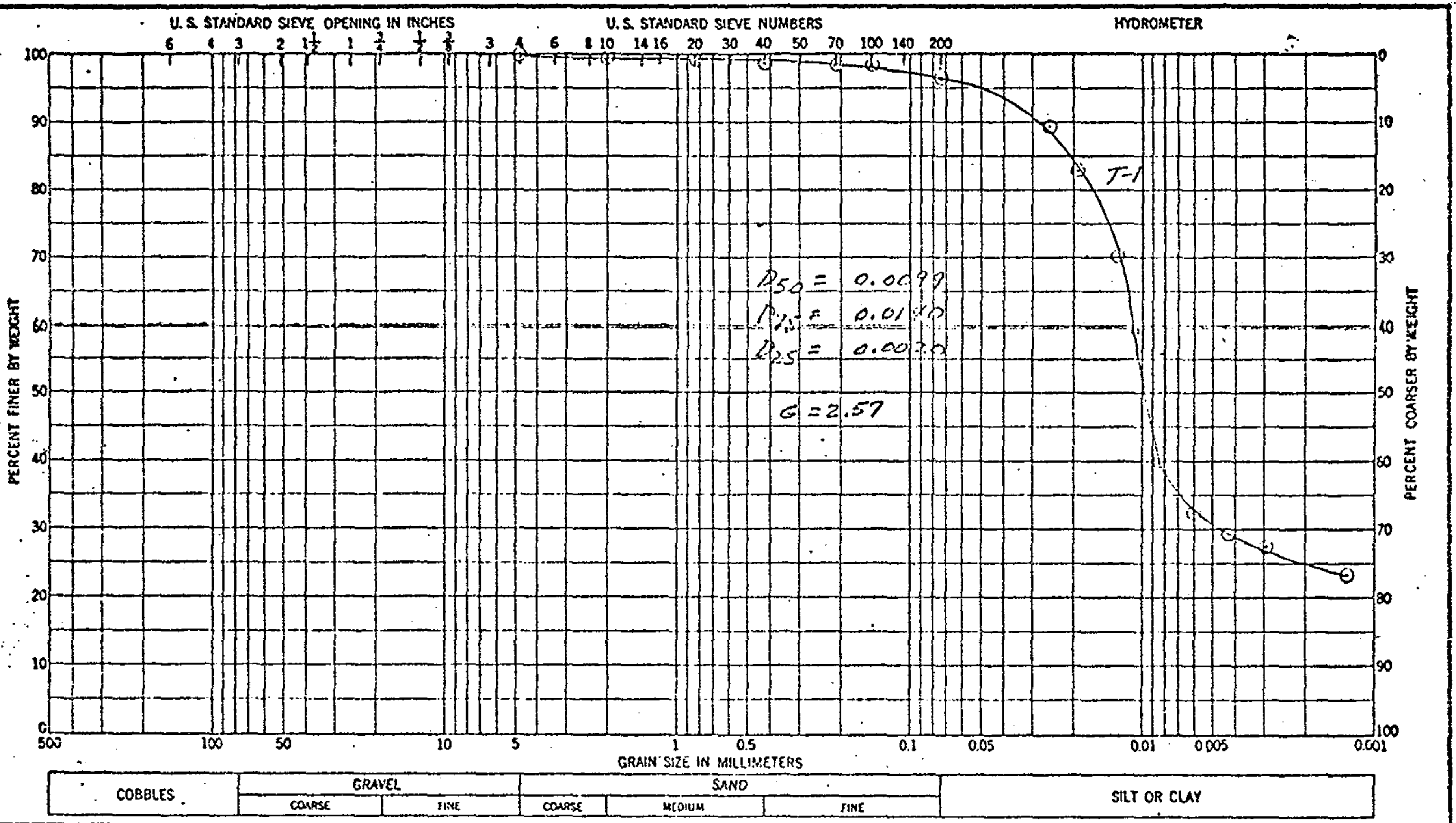
Area:

Boring No. PE-2 (Lab. Ser. No. 100-185-4)

Date: June 1975

GRADATION CURVES

ENG FORM 1 MAY 63 2087



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
T-1	0.0'-2.2'	ORGANIC SILT (OH)		111	48	63

Project Midnus River, Conn.

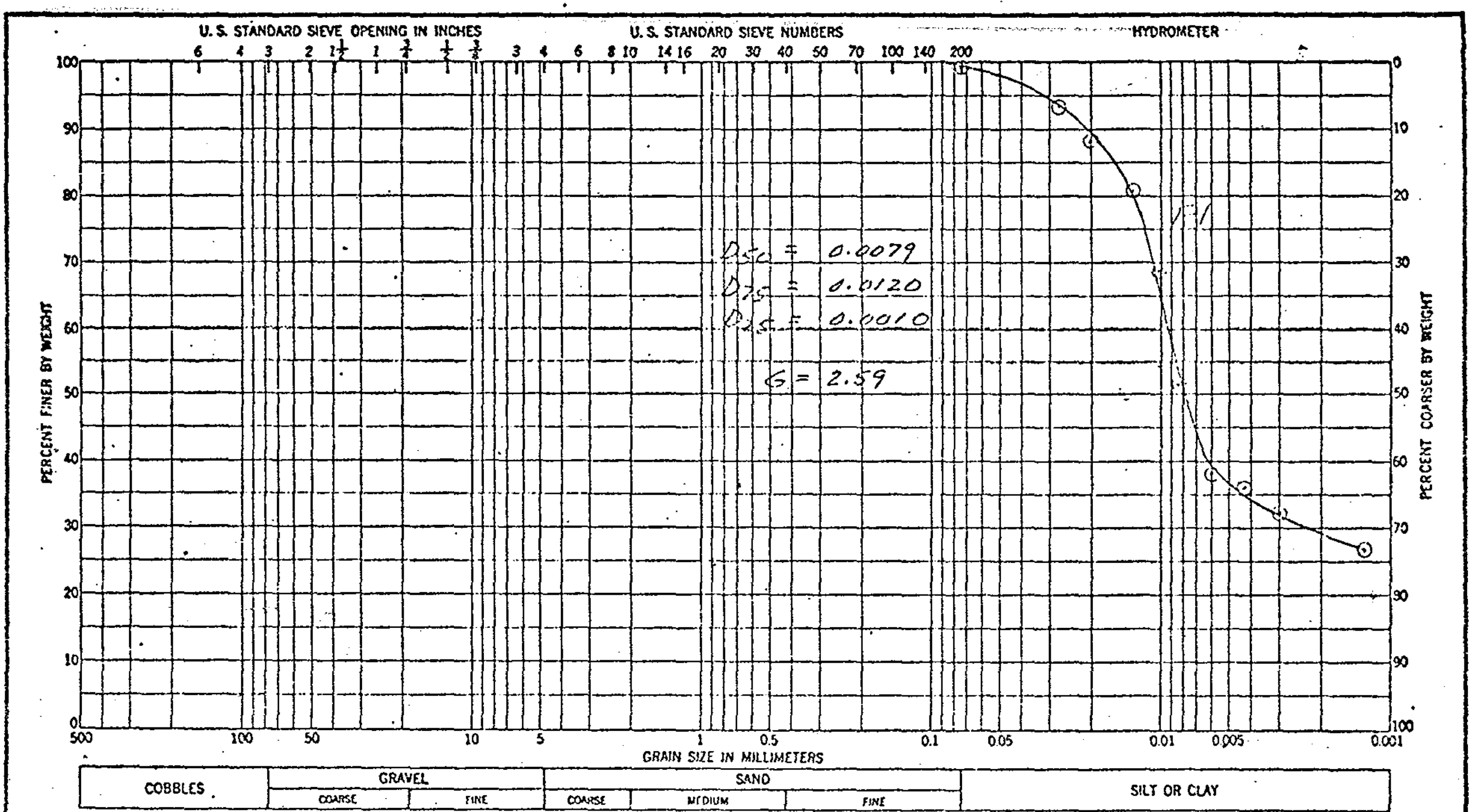
Area

Boring No. PE-3 (Lab. Ser. No. 100-185-7)

Date June 1975

GRADATION CURVES

ENG FORM 1 MAY 63 2087



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
T-1	0.0'-2.9'	ORGANIC SILT (OH)		114	52	62

Project *Mianus River, Conn.*

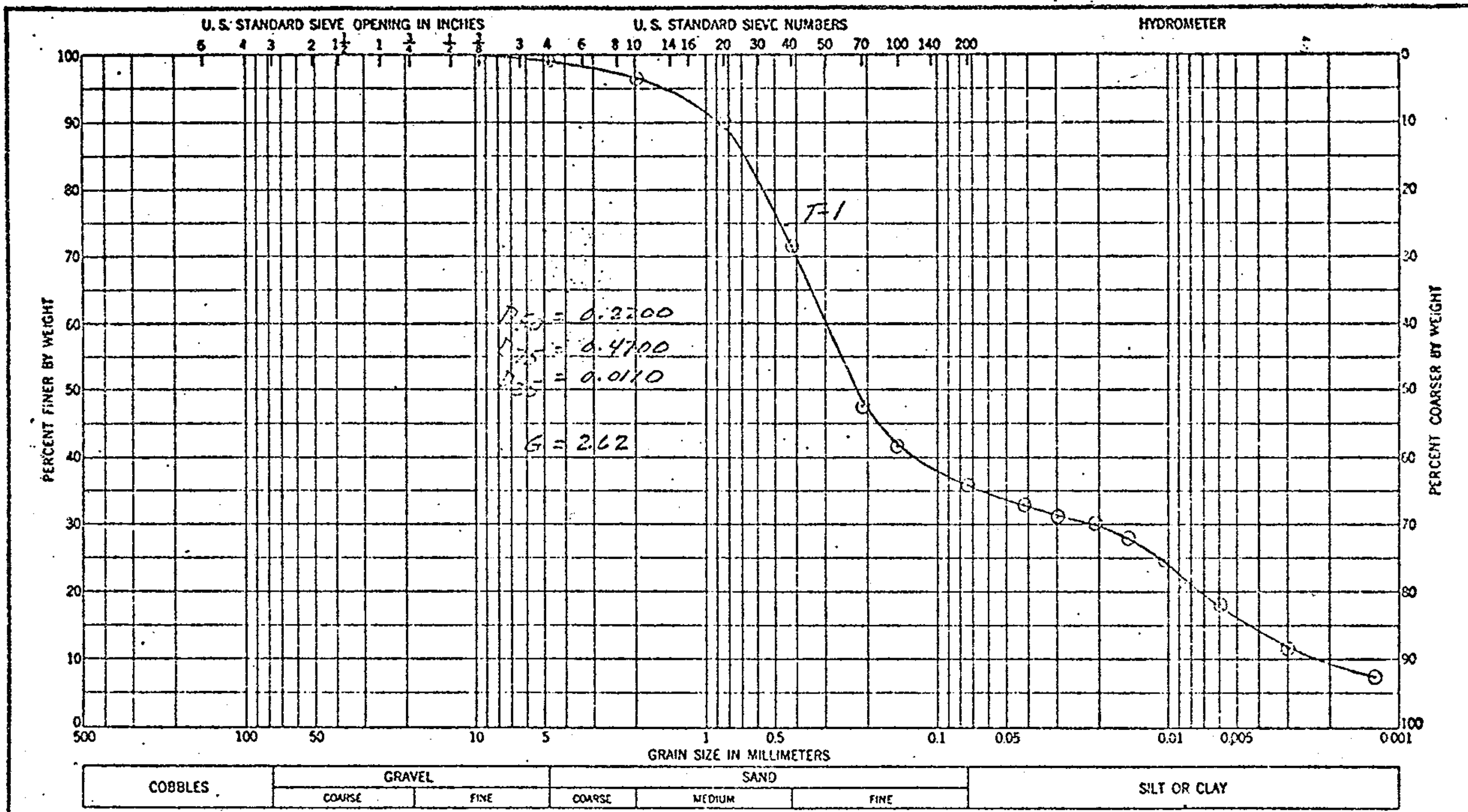
Area

Boring No. *PE-4 (Lab. Ser. No. 100-185-10)*

Date *June 1975*

GRADATION CURVES

ENG FORM 1 MAY 63 2087



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
T-1	0.0'-2.45'	silty m-f SAND (SM) w/organics		79	39	40

Project Mianus River, Conn.

Area

Boring No. PE-5 (Lab. Ser. No. 100-185-13)

Date June 1975

GRADATION CURVES

ENG FORM 1 MAY 63 2087